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HUMAN OCCUPATIONAL ILLNESS PROBLEMS DUE TO
EXPOSURE TO ETHYL PARATHION IN CALIFORNIA IN 1975

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SUMMARY

Ethyl parathion continues to be one of the most hazardous organophosphate pesticides used in California. There were 68 cases of human exposure reported for this pesticide in 1975 that involved employed persons. Of these, 46 had systemic effects, seven received skin injuries, one had an eye injury, one had an eye and skin injury, and 13 were exposed but did not become ill. Most exposures resulted from failure to follow existing label requirements and established regulations which are admittedly quite stringent and difficult to follow for this particular pesticide, but others occurred in spite of adherence to existing label requirements and regulations.

In 1975, 912,000 pounds of ethyl parathion were applied in California and obviously large numbers of persons handled this pesticide adequately without ill effects. The potential for parathion to poison humans, however, cannot be overemphasized. The ability of this pesticide to rapidly pass through the skin is its major safety hazard. In the 1975 series of human illness cases, as in previous years, many workers claimed they were not aware they had been exposed.

A number of stringent requirements are in effect and additional ones are being put into effect or are contemplated in order to limit the hazards of working with this particular pesticide. These include: (1) label requirements--current ones and contemplated changes, (2) restricted use classification, (3) additional regulations on usage designed primarily to protect the frequent user who is not adequately protected by label requirements, (4) closed system mixing and loading, (5) elimination of excess dustiness of wettable and soluble powders, (6) additional protection for ground applicators when the temperature is above 85°F, (7) field worker poisoning prevention by adhering to reentry safety intervals, and (8) suggestions to pest control advisers that alternate pesticides be recommended whenever feasible.

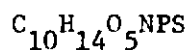
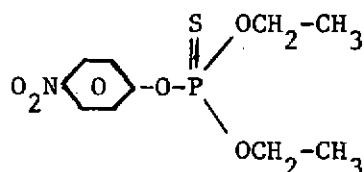
GENERAL INFORMATION ON PARATHION

Technical or chemical name: O,O diethyl O-p-nitrophenol phosphorothioate.

Common names: Parathion, Ethyl Parathion.

Trade Names: AC 3422, Alkron, Alleron, Aphamite, Bladan, Corothion, E-605, ENT 15108, Ekatox, Ethlon, Etilon, Folidol, Fosferno, Fosfono-50, Lethalaire G-54, Niran, Orthophos, Panthion, Paramar, Paraphos, Parathene, Parawet, Phoskil, Rhodiatrox, SNP, Soprathion, Stathion, Thiophos.

Chemical structure and formula:



Molecular Weight: 291.27

Chemical Properties: Parathion is an organophosphate exhibiting very low volatility (10⁻⁵ mm Hg).

Physical State: The pure compound is a yellow liquid. The technical grade material is an amber to dark brown liquid with a garlic-like odor.

Solubility: It is miscible with acetone, benzene, carbon tetrachloride, chloroform, ethanol, ether, toluene and xylene. It is slightly soluble in heptane and petroleum oils, lipids and fats. It is very slightly soluble in water. (24 ppm at 25°C.)

Use: This is a broad spectrum insecticide-acaricide which is recommended for use on over 150 common insects and mites on 66 different crops.

Application: Parathion is usually applied as a spray by an aerial or ground applicator.

Formulations: Emulsions, wettable powders, and dusts.

Origin: Bayer AG in Germany in 1944. Monsanto Co. and Kerr McGee are the principal producers in the U. S.

Combinations: Parathion is compatible with at least 70 other insecticidal and fungicidal materials. It is incompatible with alkaline materials.

Action: Parathion is an acetylcholinesterase inhibitor that is readily absorbed through the skin, stomach, and lungs. Based on the long history of use and studies of the environment of treated areas, it seems safe to conclude that bioaccumulation does not occur.

Toxicity Data: LD₅₀ Acute, oral, rat 2 mg/kg
LD₅₀ Acute, dermal, rat 7 mg/kg
EPA Toxicity Category One

Phytotoxicity: There is usually a wide margin between insecticidal potency and foliage injury, but visible foliage injury has been observed at concentrations required for effective insect control. At high concentrations of emulsion-type formulations on some crops, injury has been seen on cucumbers, tomatoes, apples, and certain ornamentals under poor drying conditions.

REPORTED APPLICATIONS OF PARATHION
IN CALIFORNIA IN 1975

<u>January - December 1975</u>	<u>Apps.</u>	<u>Pounds</u>	<u>Acres</u>
Parathion		520.41	
Agencies, Other			39,798.00
Alfalfa	407	19,748.85	49,653.00
Almonds	674	78,602.32	209.00
Apple	11	295.12	15,406.40
Apricot	322	20,805.40	31,097.50
Artichoke	698	19,356.36	54.00
Avocado	3	123.44	34,929.00
Barley	214	11,815.80	13,733.75
Beans	235	9,995.16	57.00
-U-* Beans	2	.95	7,343.00
Beets	90	3,348.41	3,955.30
Broccoli	131	2,359.27	30.00
-U-* Broccoli	1	.50	775.00
Brussels Sprouts	26	366.89	1,582.80
Cabbage	107	1,124.37	1,436.20
Carrot	30	837.26	1,549.00
Cauliflower	84	869.00	11,829.34
Celery	735	5,934.58	7.00
-U- Celery	1	.50	425.50
Cherries	22	739.75	2,869.17
Citrus, Other	100	7,854.22	44.00
Clover	1	99.00	22.00
Collard	1	16.50	10,587.00
Corn	118	18,522.91	90,312.50
Cotton	853	67,625.95	69.15
Cucumber	6	69.58	183.00
Deciduous Ornamental Trees	2	302.58	37.00
Eggplant	3	18.50	15.00
Figs	1	3.03	43.50
Flowers	14	38.95	2,431.00
Garlic	30	1,029.57	9,326.70
Grapes	199	16,770.23	522.70
Grapefruit	33	4,838.18	4,022.60
Lemon	101	10,779.44	150,487.49
Lettuce (Head)	4,688	81,621.65	11.00
-U- Lettuce (Head)	1	.50	258.00
Lettuce (Leaf)	17	153.05	2,706.50
Melons	51	1,162.89	15,575.90
Nectarines	714	21,862.55	80.00
Oats	1	60.00	3,679.66
Olives	117	7,973.61	25,536.27
Onions	488	14,797.79	45,189.12
Orange	1,554	124,048.78	40.00
-U- Orange	1	5.77	17.00
Ornamentals	6	12.00	46,435.91
Peach	1,347	81,170.62	4,606.00
Pear	53	6,463.54	1,218.68
Peas	130	553.43	

January - December 1975	Apps.	Pounds	Acres
Peppers (Bell)	18	499.71	440.09
Plum	494	18,818.41	10,721.77
Potato	63	1,598.60	2,687.36
Prune	376	32,697.24	20,242.10
Pumpkins	4	64.64	130.00
Radish	1	50.00	100.00
Recreational Areas		75.90	
Rice	1,245	29,690.29	212,999.70
Rutabaga	3	68.75	111.00
Safflower	1	65.25	75.00
School Districts		.55	
Sorghum	39	1,356.00	2,718.00
Spinach	122	2,427.00	4,567.50
Squash	49	998.64	1,735.00
Strawberries	14	407.87	424.00
Structural Control		61.00	
Sugarbeet	2,285	90,364.44	176,492.68
Sweet Potato	1	50.00	50.00
Swiss Chard	1	5.00	10.00
Tangerine/Tangelo	3	106.25	55.00
Tomato	1,281	58,959.68	97,372.50
-U- Tomato	1	2.00	15.00
Turnip	13	251.50	70.00
University of California		33.80	
Vector Control		12,442.98	
Walnut	72	4,398.63	2,533.50
-P- Walnut	1	.50	300.00
Watermelons	2	43.00	86.00
Wheat	242	12,280.40	31,273.00
TOTAL	20,746	912,517.19	1,194,946.84

* Acreage - When the commodity listed is prefixed by P or U, the amount listed in the respective acreage column is not acreage but one of the following, and is not included in total acreage.

P = Pounds

U = Miscellaneous Units

LIST OF IDENTIFIED PESTICIDES THAT CONTAIN PARATHION
AS THE ACTIVE INGREDIENT THAT WERE INVOLVED
IN CAUSING HUMAN OCCUPATIONAL EXPOSURES IN CALIFORNIA IN 1975

<u>Registration Number</u>	<u>Company</u>	<u>Name</u>
<u>16 cases</u>		
10163-50043-AA	Wilbur Ellis	Red Top Parathion 25 wp
<u>3 cases</u>		
00239-00547-AA	Ortho	Phos 4-Emulsive
<u>2 cases</u>		
05905-00255-AA	Helena	Parathion 25w
<u>1 case each</u>		
00239-00322-AA	Ortho	Parathion 25 w.p.
00279-00322-AA	FMC	Parathion
00279-02770-AA	FMC	Parathion 25w
01202-00251-AA	Purego	Parathion-4 Liquid
02935-00138	Wilbur-Ellis	Red-Top Parathion-4-Spray
05905-50006-AA	Helena	Parathion 8
05967-00062-AA	Moyer	Parathion 25w
06973-50062-AA	Soil Serv	Parathion 4/B-EC
07001-00055-AA		Parawet 25w
10231-50074-AA	WFSI	Parathion 25w
In conjunction with Lannate, Phosdrin and Malathion		
02935-00360-AA	Wilbur Ellis	E/M Parathion 6.3
In conjunction with Copper Sulfate and oil		
07001-00055-AA	Occidental	Oxy Parathion 25w

Nine cases reported did not give EPA registration numbers.

OTHER PESTICIDES THAT WERE ASSOCIATED WITH PARATHION
OCCUPATIONAL EXPOSURE CASES IN CALIFORNIA IN 1975

Oil - 5 cases
Methyl Parathion - 2 cases
Copper Sulfate - 2 cases
Malathion - 2 cases
Lannate, Phosdrin, Cygon, Dibrom, Sulfur, Manzate, Toxaphene - 1 case each.

AGRICULTURAL WORKER PARATHION OCCUPATIONAL EXPOSURES
BY CROP BEING WORKED WITH IN 1975

<u>Crop</u>	<u>Month</u>	<u>County</u>
Oranges	April	Kern (2)
	May	Tulare (4)
	June	Tulare (3)
	June	Tulare (16) (Kaweah Incident)
Peaches	January	Stanislaus (2)
	January	Sutter
	January	Yuba
	February	Butte
Almonds	January	Stanislaus (2)
	December	Stanislaus (2)
Rice	May	Colusa (2)
Apricots	March	Stanislaus
Artichokes	August	Santa Barbara
Brussels Sprouts	September	Santa Cruz
Grapes	December	Fresno
Lettuce	October	Fresno
Nectarines	May	Tulare
Olives	July	Tulare
Onions	July	Kern
Prunes	January	Yuba
Tomatoes	July	Yolo
Unspecified Crop	January	Tulare
	March	Stanislaus
	May	Tulare
	June	Monterey

SEASONAL INCIDENCE OF NONAGRICULTURAL (MANUFACTURING) PARATHION
OCCUPATIONAL EXPOSURE IN CALIFORNIA IN 1975

June in Madera County
 July in Fresno County
 July in Los Angeles County
 August in Fresno County

Other: May in Stanislaus County

OCCUPATIONAL EXPOSURE INCIDENTS INVOLVING PARATHION
BY MONTH IN CALIFORNIA IN 1975

	<u>Agricultural</u>	<u>Nonagricultural</u>	<u>Total</u>
January	8	0	8
February	1	0	1
March	2	0	2
April	2	0	2
May	8	1	9
June	20	1	21
July	3	2	5
August	1	1	2
September	1	0	1
October	1	0	1
November	0	0	0
December	3	0	3

TYPES OF OCCUPATIONAL EXPOSURES THAT OCCURRED IN CALIFORNIA
IN 1975 AND REPORTED AS DUE TO PARATHION

Systemic	46	(5 cases are questionable)
Eye	1	
Skin	7	(6 cases are questionable)
Eye and skin	1	(questionable)
Exposed, not ill	13	(2 cases are questionable as to whether an exposure occurred.)

SIGNS AND SYMPTOMS OF PARATHION EXPOSURE
AS SEEN IN CASES THAT OCCURRED IN 1975

- I. Cases listed for the most severe symptom encountered by the victim.
- II. 1 - 5 listed in order of severity of symptoms. Usually, a victim suffering from one of these symptoms will also have experienced the symptoms below, either at the beginning of the illness or in conjunction with it.
 1. Tremors - 3 cases (one case also involved malathion)
 2. Labored breathing and heavy perspiration - 1 case
 3. Nausea and/or vomiting - 33 cases (2 cases involved sulfur and oil, 2 cases oil, one case Lannate and phosdrin, 1 case malathion.)
 4. Weakness, Dizziness, Blurred Vision - 3 cases
 5. Headache - 2 cases
 6. Burning in face and eyes - 1 case (Toxaphene involved)
 7. Burning in eyes - 1 case
 8. Dermatitis - 7 cases (one case involved oil, one case Cygon and Dibrom, one sulfur, one Manzate.)
 9. Not defined in report - 4 cases.

PERIOD OF DISABILITY FROM OCCUPATIONAL EXPOSURE TO PARATHION
IN CALIFORNIA IN 1975

Hospitalized

17 workers hospitalized

- 1 worker for 1 day
- 1 worker for 1-2 days and subsequently missed 1-2 weeks work.
- 3 workers for 2 days (one worker also missed 30 days work).
- 2 workers for 2-3 days
- 1 worker for 3 days and subsequently missed 15-20 days work.
- 1 worker for 4 days and subsequently missed 7 days work.
- 1 worker for 5 days
- 1 worker for 7 days and to miss 14 days work
- 1 worker in intensive care for 1 day - total stay indefinite
- 1 worker for greater than 5 days
- 4 workers for an indefinite period of time

Although all the reports did not state how long the employee was out of work, usually all workers listed missed at least seven days (one week) of work in addition to their hospitalization. Patients with symptoms so severe that they require hospitalization cannot be expected to return to work at full capacity for at least this long. It is also assumed that if some type of work is resumed, it will not involve exposure to organo-phosphates or carbamates for at least 30 days beyond the onset of illness in order to allow the cholinesterase enzyme levels to return to legal levels.

Ill But Not Hospitalized

26 workers ill

- 5 workers missed 1-3 days work
- 4 workers missed 2 days work
- 1 worker missed 4 days work
- 3 workers missed 7 days work
- 13 workers missed work but reports did not specifically state how long.
- 20 workers apparently did not miss any work following exposure to parathion.
- 5 reports were incompletely filled out and did give adequate information.

CASE REPORTS OF OCCUPATIONAL EXPOSURE TO PARATHION
IN CALIFORNIA IN 1975

SYSTEMIC ILLNESS - PARATHION ONLY

Kaweah Incident

In the only incident that involved multiple exposure, 17 alien field workers with illegal work permits, in order to avoid contact with the U. S. Border Patrol, slept at night in a grove that had been recently sprayed with ethyl parathion and posted with warning signs. Along with three others, these 17 workers also entered two fields in advance of the expiration of the 21-day safety interval. One field was reentered one day early, the other was reentered five days too early. Sixteen workers eventually developed symptoms typical of organophosphate poisoning, three of which were hospitalized overnight. Plasma cholinesterase values for 19 of these 20 workers were below the lower end of the normal range.

This particular incident involved six different alleged violations and legal action was taken against the grower:

1. Too early reentry - one field - one day.
2. Too early reentry - one field - five days.
3. Failure to take ill employees to a physician.
4. Failure to make prior arrangements for medical care.
5. Failure to post warning signs in an appropriate foreign language.
6. Making false records.

Individual Cases

A ground applicator became ill after wind blew the parathion spray in his face. He experienced weakness, salivation, and nausea. Although he was wearing all the required protective clothing, the report indicates that the employee did not discontinue spraying even though the wind was continuing to blow parathion in his direction. This incident could have been prevented if the employee had stopped spraying into the wind, and washed thoroughly once he realized the spray was being blown toward him.

An employee started feeling nauseous after loading and applying parathion. Although not hospitalized, he missed two days work due to this exposure.

A ranch foreman, making minor repairs to a spray rig was treated for nausea and chills and missed two days work. Although knowledgeable about safety procedures, he did not wear protective equipment even though it was available.

An employee was sent to the hospital and missed two days of work after becoming nauseated when spraying with parathion. All the required safety equipment was not issued or worn although employer and employee knew that they were required. This incident might have been prevented if all safety precautions had been observed.

A ground applicator developed a severe headache after spraying with parathion for about four hours. The employee used all required safety equipment and avoided drift. However, he had worked with this pesticide for 41 hours in the previous 30 days, so this could have been a case of chronic poisoning. Checking of cholinesterase levels about every two weeks might have prevented this illness.

A ground applicator experienced nausea and missed two days work after spraying parathion without a respirator, even though all protective clothing was required and available. This is another example of an employee not using all safety equipment.

An employee missed more than two weeks of work because he refused to wear a respirator when mixing parathion. He experienced nausea and vomiting and was hospitalized for three days. All safety equipment was provided. This incident could have been prevented if the employee had followed all safety precautions.

An aerial applicator experienced a severe headache, vertigo, and extreme weakness after apparently flying through drift from his own plane while round-robbing with a partner. Although a respirator was provided, it was not clear whether the pilot wore one. This incident need not have happened, had the pilot been more aware of wind direction and flow of the drift from his airplane.

A field worker entered an orange grove that had been treated with parathion a few hours earlier. He experienced nausea and vomiting for two days. Although protective clothing was available, none was worn. The employee apparently did not notice the signs telling of the danger of entering the grove.

A farm mechanic became very sick and started vomiting after doing some metal cutting with a torch on a sprayer that had residual parathion on it. He was not working in a well-ventilated area nor was he informed of the possible danger involved. Better communication between employer and employee could have easily avoided this needless accident. A mask with an appropriate filter was needed.

A ground applicator developed a headache and became nauseous after spraying with parathion. He was provided with and used all safety equipment. The employee was quite tired and suffering from sinus trouble at the time of injury which may have aggravated his condition. He missed two days of work. This incident could have been prevented if the employee had used parathion only when he was not suffering from any illness that could increase his chances of becoming affected by the parathion spray.

A mixer/loader had been working for about three hours when he became nauseated and weak and had to be hospitalized for two days. Although protective equipment was available, the employee refused to wear the hard hat and face shield required for the job he was doing. This may have been the cause of the exposure to the insecticide.

A ground applicator spilled some parathion on his hands and he failed to wash immediately. He experienced nausea, began vomiting, and was hospitalized for two days. This incident could have been prevented if the employee had worn all safety equipment and followed all safety procedures.

An employee bagging material at a chemical plant failed to wear his goggles although they were supplied and required for bagging dry pesticides. He experienced labored breathing and heavy perspiration and was hospitalized in the intensive care ward for one day. This could have been avoided had the employee followed all safety precautions.

A laborer in a manufacturing plant was cleaning out material that had been utilized the previous day to formulate wettable parathion. He experienced muscular tremors and was hospitalized for three days. Although he was wearing all the necessary safety equipment at the time, the plant was extremely hot during the morning work hours. This may have aggravated his condition. Also, since the victim did not feel ill until after he ate lunch, there is a possibility that he ingested some parathion by contaminating his food from incompletely washed hands. It is difficult to say whether this illness could have been prevented, as the employee was wearing all required safety equipment and there is no hard evidence as to exactly how he was exposed to parathion.

A mixer/loader became nauseated and vomited after he smoked some cigarettes and ate his lunch on top of a nurse unit that he was using to mix parathion. He was hospitalized for two days. Although he was issued all protective equipment and had been trained, the employee admitted he did not wear all of it when mixing. This incident could have been prevented if the employee had observed all precautions and regulations.

A worker storing nearly empty parathion drums had some parathion spill on him. He suffered from nausea and fatigue and was hospitalized for one week, missing a total of two weeks work.

An applicator was spraying parathion. He became ill and experienced headache and nausea. No other details were given on this incident.

An employee was cleaning a spray rig that was used for parathion application and upon opening a filter, "something" was propelled into his mouth, which he subsequently swallowed. The victim started to feel nauseous and dizzy, but when atropine was given as treatment, these also made him quite ill. This suggests that parathion may not have been involved in this incident. Also, his cholinesterase tests showed normal values. The object swallowed was never identified. This incident could have been prevented if the employee had been wearing a respirator or a face shield, which had been provided.

A cleanup man in a formulating plant spilled parathion on his face and allowed the chemical to get on his arm through the glove gauntlet that he was wearing. A few hours later, he began feeling weak and started vomiting. Although all required protective clothing and equipment had been furnished, the employee was not cautious or careful in his handling of the insecticide.

A mixer/loader picked some oranges with contaminated gloves he had worn just previously to mix parathion. He then pulled off the gloves, peeled the oranges and ate them without washing his hands. The report was not definite as to his exact symptoms and the poisoning may have been influenced by the fact that the employee was said to have been showing effects of excess alcohol consumption the previous evening.

A worker helping to fill a spray tank with parathion started to feel weak after about four hours and was subsequently hospitalized for about a week.

SKIN CASES - PARATHION ONLY

A ground applicator using parathion complained about redness and slight burning on his cheeks around his face mask. The doctor's report stated that dermatitis due to a chemical exposure was possible. It is improbable that any insecticide was involved in this particular situation since this is a common discomfort associated with using a respirator.

A mixer/loader working with parathion for an unstated period developed a rash on his back and arms. The doctor reported that it was unclear whether the rash was a job-related allergy or just a sunburn.

After spraying with parathion and other chemicals for several days, an employee developed a rash on his scrotum and hands. He was supplied with and used all required protective clothing. The employee stated that he felt the rash could have been caused by not washing hands before urinating. There is some doubt whether this injury was caused by parathion as the employee was also working with other chemicals at the same time. Also, parathion usually causes systemic injuries, not rashes. This could have been prevented if the employee had washed thoroughly after using the pesticide mixtures.

EYE EXPOSURE ONLY - PARATHION ONLY

A spray rig operator was opening bags of parathion and hitting them on the dome opening of the spray rig when the end of the bag facing him burst and parathion blew into his face. He experienced a burning in his eyes, but no usual parathion symptoms. This incident could have been prevented if the employee had been wearing a face shield and/or a respirator at the time as required and had been opening the bags properly.

SYSTEMIC ILLNESSES - PARATHION AND OTHER PESTICIDES OR DRUGS INVOLVED OR SUSPECTED

A mixer/loader experienced blurred vision, nausea and vomiting after working with a parathion and malathion mixture. He may have been exposed to the fumes while mixing. He was wearing all required protective gear and following all specified safety precautions at the time of the incident. However, the victim had been sick on and off for a few months before the incident and seems to be very sensitive to allergies as a recent bee sting also made him very ill. This incident might have been prevented if the employee had not used organophosphates when in poor health.

A ground applicator was hospitalized for two days when he accidentally let some spray containing parathion and malathion get on his coveralls. He experienced blurred vision, nausea, mild tremors and stomach cramps. This incident could have been prevented if the employee had changed his clothes and washed up immediately after having any contact with the spray.

After cleaning out a spray tank that contained parathion, a mixer/loader complained of nervousness and blurred vision. Although safety equipment was required, it was noted that the employee wore the equipment infrequently.

A mixer/loader became ill and began vomiting after working with Lannate, Phosdrin, and a parathion emulsion mixture. He was wearing all required protective clothing and was observing all safety precautions but the victim was suffering from anemia and ulcers at the time of the exposure. This may have contributed to his symptoms. This incident could have been prevented if the employee had not used the pesticides unless he was in reasonably good health.

A ground applicator became dizzy and shortly afterward began vomiting after working with copper sulfate, oil and parathion for two weeks. He wore all specified protective clothing and he stayed out of the drift at all times. No violations of worker safety regulations were apparent. This might have been a case of chronic poisoning, frequent cholinesterase tests might have detected excessive exposure prior to the onset of symptoms.

A tractor driver was disking a walnut orchard that had been sprayed with parathion when he became nauseated and vomited. The employee was on medication (Nicobid) at the time. He complained of nausea from Nicobid also, so the symptoms observed may not have been exclusively from parathion exposure. This incident could have been prevented if the employee had not exposed himself to any pesticides or pesticide residues when not in generally good health or under medication.

After spraying with parathion and oil for three days, a ground applicator complained of weakness and slight nausea at the beginning of the fourth day. All equipment was worn, and cholinesterase tests proved normal. There is doubt whether this is an actual poisoning since cholinesterase levels were reported as in normal ranges and the patient was not given any treatment after seeing a physician.

A ground applicator started feeling ill and vomited after spraying with parathion, copper sulfate and oil. He was issued and he wore all required protective clothing. Cholinesterase levels were in the normal ranges and the employee was only diagnosed and treated for anxiety. No specific treatment was given for organophosphate poisoning. It is not likely that this was a pesticide poisoning case.

SKIN CASES INVOLVING POSSIBLE EXPOSURE TO PARATHION AND OTHER PESTICIDES

After spraying with a mixture of parathion, Cygon, and Dibrom for several days, a worker noticed a rash on both hands which was diagnosed as contact dermatitis from the pesticides. Although full

safety gear was worn, it is believed that the employee took his gloves on and off during the mixing operation, which led to his exposure. This incident could have been prevented if all safety precautions had been followed.

A laborer developed a rash on his hands, feet, and legs after what may have been an early reentry to a field treated with ethyl parathion and Manzate. He did not experience any of the usual organophosphate poisoning symptoms even though his red blood cell and plasma levels of the cholinesterase enzyme were at the lower limits of the normal range. It is highly likely that Manzate caused the rash and not the parathion.

While spraying with parathion and oil, a ground applicator stopped to urinate. A few hours later he noticed a rash on his penis and he felt some burning. This is probably an allergic reaction and it is not clear whether parathion or the oil was involved. This incident could have been prevented if the employee had washed his hands thoroughly before touching any part of his body.

A field worker developed a rash on her arms after picking oranges in dusty trees. The grove was sprayed 31 days earlier with a mixture of parathion, urea and sulfur. The rash was probably from sulfur exposure and not from parathion.

SKIN AND EYE CASE INVOLVING EXPOSURE TO PARATHION AND OTHER PESTICIDES

An employee was shoveling dirt out of a ditch at the edge of a tomato field when he got dust on his face and eyes, which started to burn. The employee stated he had seen a ground rig spraying three to four days earlier so he may have gotten a reaction from residue material on the soil. Parathion and toxaphene had been sprayed on the soil. It is not very likely this is a pesticide-caused injury.

CASES INVOLVING EXPOSURE TO PARATHION WITH NO ILL EFFECTS

A mixer/loader was exposed to parathion when some parathion dust worked its way around the respirator and entered his mouth and nose. No symptoms were experienced by the employee and no treatment was given. All protective equipment was worn. It seems the face mask did not properly seal, even though employee stated it fit properly. This incident might have been prevented if the employee had double-checked all his equipment before using.

An employee was exposed to an ethyl/methyl parathion mixture when the container he was loading in a pickup truck broke and spilled on his body. He disposed of the container improperly, for which he was cited. The patient was treated for severe anxiety and not organophosphate poisoning.

While working on a spray job, an employee was sprayed in the eye with parathion when an operator turned on the spray rig before the

employee was clear of the equipment. No ill effects were reported. This could have been prevented if the operator simply used common sense and waited until everyone was clear of the area before turning on the sprayer.

An airplane applying parathion crashed into sand dunes adjacent to the field after fog settled in and obstructed his view. The employee was not injured in the crash, nor did he experience any toxic symptoms from his exposure to parathion. This incident could have been avoided if the pilot checked weather conditions earlier. The pilot should have stopped spraying as soon as the fog started to move in.

A Highway Patrol officer in Yolo County found three five-gallon cans along the roadside and in the process of moving the cans off the road, one of the containers leaked parathion on his hands. He immediately washed his hands thoroughly and sought medical assistance. The officer did not experience any symptoms. This exposure probably could not have been easily avoided, because leaving the parathion containers on the road was unwise. The officer should have used gloves when moving the cans, but he may not have had any in his car at the time. Writing permit numbers on the container, as is required in Imperial County, would probably have led to the identification of the person responsible for the violation of the regulation concerning the handling of containers.

Two employees were replacing a faulty valve on an aircraft loading system when pressure in the line caused "a substance" to be sprayed on their clothing. There is doubt as to whether parathion was involved. The employees were not wearing protective clothing because the system had been previously washed out with 240 gallons of water and they did not expect any pressure in the hose.

A pilot was exposed to parathion when hoses aboard his plane ruptured and sprayed his body and face with the insecticide. The pilot washed up and changed clothes immediately. He did not experience any toxic effects of the chemical. This incident could have been prevented if shields were installed on the hoses since the pilot operated in an open cockpit.

A newspaper reporter covering a pesticide fire accidentally stepped in some contaminated water from fire-fighters' hoses. He immediately washed his feet and was given cholinesterase tests. No symptoms appeared and he resumed work the next day. This incident could have been prevented if the reporter had been more aware of the spray and runoff of the fire-fighters' hoses. Also, measures should have been taken by the fire-fighters and the police to restrict all persons from the general area during this type of a fire.

DISCUSSION

Ethyl parathion continues to cause human illnesses in numbers of persons exposed as users and field workers far out of proportion to its usage as compared to other pesticides. It was one of the first

organophosphate pesticides registered and it has only a small safety factor between its high killing potential for insects and its very high (dangerous) dermal toxicity ratings for man. In the past five years in California, the California Department of Health has received physicians' reports on 351 occupational parathion exposure incidents. Most of these incidents involved an illness; there was one death. Not all occupational incidents of employed persons are reported. This pesticide is also widely used on smaller farms that may not have employees; pesticide related exposures not involving employees are usually not reported. It has become apparent through the experience of medical supervisors that parathion and one other pesticide are responsible for the majority of the many occupational exposures in California in which there is significant cholinesterase depression without clinical symptoms. Phosdrin is the other organophosphate widely used with serious safety problems.

Beginning with the first use of parathion in California in the late 1940's, it has been recognized that although this is a very effective pesticide, it has to be used with great care to avoid adverse human effects.

A number of combined approaches have been put into effect or are going into effect to limit the hazards of parathion usage:

1. Labeling - The labels currently required for parathion are the best pesticide labels in use today that specifically warn of the hazards to be encountered by the user and give the measures necessary to avoid the hazards. Conscientious adherence to the label requirements usually, but not always, prevents excess human exposure.
2. Restricted Use Classification - Requiring permits for use of parathion has limited its use in general to persons who are more likely to use it correctly.
3. Additional Regulations on Usage - Although occasional use in accord with the label usually does not result in adverse human effects, it has been found desirable to protect the frequent user of parathion from adverse health effects to require medical supervision, frequent testing of blood for cholinesterase levels, clean outer clothing daily and other safe work practices.
4. Closed System Mixing and Loading - Use experience by even careful and qualified users has demonstrated that accidents of spillage of small amounts of liquid will occur from time to time. This is one of the most serious hazards with parathion usage because of the ease with which it passes through human skin. Closed system handling will be required to handle liquid formulations of this pesticide after January 1, 1977.

5. Dusty Wettable and Soluble Powders - Inhalation hazards to persons working with these formulations need additional attention. A tight standard for lack of dustiness should be met or else these formulations should only be sold in water soluble packages that can be put directly into the mixing tank.
6. Protection of Ground Applicators - Above 85°F it is difficult to keep the complete body suiting required by the label on the driver of an open cab application vehicle. Since OSHA regulations prohibit the use of protective gear that will heat-stress the worker, this work cannot be continued above 85°F unless cooled air is provided under the suiting or a protective cab is provided that keeps spray mist off the worker's skin. Clarification of ways of meeting these requirements are needed on the label or by regulation.
7. Field Worker Poisoning Prevention - In general, it is possible to enter most fields to carry on necessary work as soon as pesticide spray has dried or the dust has settled so long as contact with treated foliage is avoided. Often a wait of an hour is all that is necessary for most pesticides. For parathion, each year there are several poison episodes in persons who have entered parathion-treated groves or fields and have been poisoned even though plant contact was carefully avoided. It appears that labels or regulations should prohibit any entry for 24 hours unless the full suiting required of the applicator is worn. Since parathion breaks down on foliage and in dry soil to the more toxic paraoxon, it has been found necessary to impose reentry safety intervals of up to 45 days on some crops to protect field workers who will be contacting the plants. Adverse health effects are rare when workers and employers adhere to the regulations specifying these intervals. A majority of the identified field worker organophosphate poisoning episodes have involved parathion.
8. Usage Recommendations - University personnel, entomologists, and pest control advisers often play key roles in determining when parathion will be used. Even though the phasing out of a number of the organochlorine pesticides has resulted in increases in uses of most organophosphates, the many problems associated with parathion has resulted in decreased use. Persons making recommendations on pesticide usage should be encouraged to recommend the use of satisfactory alternate pesticides which are available for most of the uses for which parathion is recommended.